UDC 621.391.812

WIRELESS TRANSMISSION OF TELEMETRY DATA TO LONG DISTANCE

I. SHPAK, S. ABRAMENKO
Polotsk State University, Belarus

The article presents a practical experiment of the developed module which uses one of the varieties of LPWAN (Low-power Wide-area Network) technology. The system is based on UBN (Ultra NarrowBand).

Technical characteristics. An ultra narrowband receiver is highly selective and it can reject noise and interference. It enters the receiver outside its narrow bandwidth, enabling an acceptable signal-to-noise ratio to be achieved with a relatively weak received signal. Consequently, transmitter power levels can be low and the effective range of transmissions may be greater than would typically be the case for technologies which do not provide such selectivity. Some other radio technologies, such as direct sequence spread spectrum and chirp spread spectrum[1], employ alternative approaches to selectively extract signals from interference and noise. Typical UNB systems operate with a bandwidth of a few 10s to a few 100s Hz[2] and are used for the transmission and reception of digital signals [3].

The use of highly selective filters in UNB receivers can provide very effective rejection of UNB signals from other UNB devices on adjacent carrier frequencies, permitting the operation of many devices in a limited geographical area.

UNB technology is often used where links from very high numbers of devices are needed, with relatively small amounts of data being exchanged on each link. Some such applications can be found in the Internet of things, with UNB being one of the technologies that have been used to implement Low-Power Wide Area Networks. [4]. Short infrequent transmissions with low transmit power can enable long-life, battery-powered operation of UNB devices connected in a LPWAN.

Typical properties of UNB devices operating in the UHF spectrum below 1 GHz have been described by ETSI; whilst specific UNB-based protocols for the implementation of LPWAN have also been standardised (alongside others) by ETSI.

System characteristics. The distance test in urban development was carried out using the developed module based on the AX8052F143 chip with the installed TCXO thermally compensated generator. We used software settings optimized for data transmission over long distances - 1200 bit / s, deviation ± 1.75 kHz, BW filter Rx 10 kHz. Frequency offset compensation was performed for each packet:

- output power: 15 dBm;
- frequency: 868 MHz;
- Location: Vitebsk, Belarus.

In the calculations, a Friis formula and a two-beam propagation model were used to obtain a realistic estimate of the communication range. The two-beam model takes into account the earth's surface, the influence of which will always reduce the attainable distance. The model takes into account various building materials, which are used to estimate the distance inside buildings more accurately.

The reviewed field test examples demonstrate the importance of considering antenna height and line of sight limitations in order to achieve greater distance for both direct visibility scenarios and indoor communications.

Results. The results obtained during transmission inside the building with the receiver located on the staircase of the 9th floor and the transmitter located on the 1st floor of the staircase: signal level at the receiver input: -95 dBm, 5% of the packets are lost.

The results obtained during data transmission in urban areas, when the receiver was placed on the balcony of the 7th floor, amounted to: distance 740m, signal level at the receiver input -110dBm.

Conclusions. The developed system meets the expected characteristics (range, power consumption, signal level) and allows you to implement a cost-effective product for the Internet of things.

REFERENCES

1. IEEE Computer Society, (August 31, 2007). IEEE Standard 802.15.4a-2007. New York, NY: IEEE.

2. Anteur, Mehdi; Deslandes, Vincent; Thomas, Nathalie; Beylot, Andre-Luc (December 2015). Ultra Narrow Band Technique for Low Power Wide Area Communications. IEEE Global Communications Conference (GLOBECOM).
2. ETSI TR103 435 System Reference document; Short Range Devices Technical characteristics for Ultra Narrow Band SRDs operating in the UHF spectrum below 1 GHz CA, USA, 2015.
3. Low Power Wide Area Networks: An Overview, Published in 2015 IEEE Global Communications Conference (GLOBECOM).